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# FIELDIANA Zoology

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## An Evaluation of Seth E. Meek's Contributions to Mexican Ichthyology

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Seth Eugene Meek pioneered in serious exploration of the fresh-water fish fauna of México during April to June, 1901, and February to May, 1903. On the first expedition he was accompanied by F. E. Lutz who served as a volunteer assistant. Travel was by railroad since serviceable roads were non-existent for coverage of this topographically diversified country. Meek early recognized the inherent interest México holds for biology in the interdigitation of tropical (lowland) and temperate (highland) faunas, as well as the presence of elements unique to the country; he also realized the biogeographic value of fresh-water fishes in deducing former hydrographic connections (Meek, 1903).

His studies culminated in a book (Meek, 1904) treating the fresh-water fishes north of the Isthmus of Tehuantepec, in which the 1901 and 1903 localities are fully listed and some are mapped. All of the material in his preliminary contribution (Meek, 1902) is included in the more definitive 1904 work. My purpose in reviewing this work is to update Meek's results, giving the reasons for my conclusions when they differ from his, as the necessary basis for the systematics of a book I am writing on Mexican fresh-water fishes.

I have examined all of the type specimens (most paratypes as well as holotypes) representing the new species that Meek described from México. It is to be expected that during the nearly 75 years since his book appeared, changes in nomenclature and in species identifications would be inevitable. Meek did much of the spadework

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that has enabled subsequent workers to expand and improve knowledge of the Mexican fish fauna; many of his collections provide an invaluable resource because human-associated perturbations have since so modified the collecting sites that much of the fish fauna has been destroyed—through damming, diversion of water for irrigation, excess pumping, mining of ground water, pollution from the oil and sugar cane industries, and elimination of native species by introduced (exotic) competitors and predators.

I am much indebted to Loren P. Woods for loans of type and other material and for facilities and courtesies given me during an intensive period of study at Field Museum of Natural History. I am grateful to the John Simon Guggenheim Memorial Foundation for support as a Guggenheim Fellow while preparing this paper, and to Carl L. Hubbs for suggestions. Rainer Zangerl kindly x-rayed type specimens for me.

In making these evaluations I have enjoyed the advantages of the great growth in knowledge of North American ichthyology since the work by Jordan and Evermann (1896-1900), of refined equipment and techniques, of my own field work in México over a 25-year period (1950-1974), and of helpful information in the largely unpublished studies (begun in 1930) of the fishes of northeastern México by Carl L. Hubbs and Myron Gordon. Even so, I am certain that some of my conclusions will be altered by future students (if not by myself) as more material and newer methods of approach become available.

Unfortunately, at the time of his field work, southeastern México was wholly inaccessible to Meek. In this area is the richest fish fauna of northern Middle America, that of the great Rio Usumacinta basin (Miller, 1966) and some of Meek's misidentifications of cichlids from Veracruz and Oaxaca resulted from his lack of familiarity with this diversified fauna, which is especially rich in these fishes with as many as 10 species of *Cichlasoma* living together in a single small lagoon.

The fishes treated here in detail are those whose specific identifications are different from the ones used by Meek (1904), but I have also included changes in generic nomenclature. To simplify comparison I have followed the sequence of families utilized by Meek, although this will differ considerably in my own book. No comments are offered here on Meek's introductory material (1904, pp. xxv-lxii). Abbreviations used are: CAS-SU, Stanford University material at the California Academy of Sciences; FMNH, Field Museum of Natural History; UMMZ, University of Michigan Museum of



Zoology; and USNM, United States National Museum of Natural History.

### Petromyzontidae

*Lampetra spadicea* Bean, a southern relict confined to the distinctive Río Lerma basin of México, has been placed in the genus *Tetrapleurodon* (see remarks in Hubbs and Potter, 1971, p. 47), where Alvarez (1966) assigned it when he described a second, nonparasitic derivative, *T. geminis* Alvarez, that inhabits the same basin. The generic classification of lampreys has fluctuated considerably, the Mexican species having been assigned to three generic names (*Entosphenus*, in addition to the above two). What the final disposition will be is uncertain; see for example, the discussion by McPhail and Lindsey (1970, pp. 52-54).

### Lepisosteidae

Four species of gars occur in México: *Lepisosteus osseus* (Linnaeus), *L. oculatus* Winchell, *L. spatula* Lacépède, and *L. tropicus* (Gill). All but the last live only in eastern México (Río Pánuco basin northward). Meek's tentative inclusion of *L. platostomus* Rafinesque as probably inhabiting northeastern México presumably refers to *L. oculatus*, which has been recorded from the U.S. portion of Laguna Madre (as *L. productus*) by Breuer (1962, p. 173) and also lives in the Río Salado, Río Alamo, and Río San Fernando, Nuevo León (Contreras-Balderas, pers. comm., 1975). The gars at Tampico, referred by Meek to *L. tristoechus* are *L. spatula* (Darnell, 1962, p. 319; Reséndez, 1970, p. 90).

## CATFISHES

Meek's treatment of the catfishes, which he assigned to the Order Nematognathi (currently called Siluriformes), needs considerable modification. His Siluridae includes the Ariidae (his Tachysurinae), Ictaluridae (Ichthyaelurinae), and Pimelodidae (Pimelodinae).

### Ariidae

The ariid *Galeichthys aguadulce* Meek is a valid species restricted to fresh water that should be placed in the genus *Cathorops* Jordan and Gilbert (W. Ralph Taylor, pers. comm., 1974).

*Conorhynchus nelsoni* Evermann and Goldsborough is an ariid and was assigned to a new genus, *Potamarius*, by Hubbs and Miller (1960).

### Ictaluridae

The ictalurids *Ictalurus* (*Ichthyaelurus* of Meek) and *Amiurus* (*Ameiurus*) have generally been placed in a single genus since Taylor (1954, p. 43) explained his reasons for combining the two. Although one could argue for generic recognition of *Amiurus* (based in part on distinctive osteological traits) that argument would fail to be convincing as long as we know so little about Mexican ictalurids. The only solution to this dilemma is vigorous collecting of catfishes with effective gear in all Mexican fresh waters that are known to harbor bagres. Until this is done and the material studied in depth, our ideas of the taxonomy of Mexican ictalurids will remain incomplete and speculative.

I suggest that perhaps there has been an undue preoccupation with (or overemphasis on) maxillary barbel length, anal-ray number, and ornamentation of the pectoral spine. To be sure, these characters are very useful but new ones need to be found in order to overcome the parallelisms that seem to be represented amongst ictalurid (and other catfish) taxa. Preliminary study indicates that gill-raker number (heretofore virtually ignored) will be a useful character, but karyotypes and perhaps biochemical data should also be helpful in deciphering the relationships of this important autochthonous American family.

*Istlarius balsanus* Jordan and Snyder is now generally placed in the genus *Ictalurus* except by Alvarez (1970, pp. 72-73). It has a three-chambered swim bladder like *I. furcatus* (Lesueur) and is a close relative of that species (Lundberg, 1975).

*Leptops olivaris* (Rafinesque) is now referred to the genus *Pylodictis*. It occurs on the Atlantic slope southward to the Río Pánuco basin (UMMZ 180035).

### Pimelodidae

*Rhamdia oaxacae* Meek, a member of the Pimelodidae, is not a valid species; probably it should be referred to *R. guatemalensis* (Günther), as was done by Hubbs (1936a, p. 193). Not all of Meek's records pertain to *guatemalensis*, however. Specimens from Córdoba and Motzorongo are, or include, *R. motaguensis* (Günther) or a representative form, perhaps *R. laticauda* (Heckel) which has priority.

*Rhamdia brachypteras* (Cope) may be the same as *R. motaguensis* (or *laticauda*).

I have examined the specimen (USNM 50483) collected by Nelson and Goldman from Frontera, Tabasco, that was recorded by Meek

(following Evermann and Goldsborough) as *Rhamdia wagneri* (Günther), and identify it as *R. guatemalensis*. All material of *Rhamdia* that I have seen from the lowlands of southeastern México is referable to *guatemalensis* as currently recognized except, possibly, *R. boucardi* Regan from Yucatán.

### Catostomidae

Although he did not list *Ictiobus* in the synonymy of *Carpiodes*, Meek included the following valid species of that genus in his treatment of *Carpiodes*: *I. meridionalis* (Günther), *I. bubalus* (Rafinesque), *I. niger* (Rafinesque), and *I. labiosus* (Meek). The first, second, and fourth citations given by Meek under *Carpiodes tumidus* really refer to *I. bubalus*; the third citation refers to *I. niger* (see Hubbs, 1930, pp. 11-13). Meek's nominal species *Carpiodes microstomus* and *Carpiodes elongatus* are both referable to *Carpiodes carpio* (Rafinesque), as determined by Hubbs and Black (1940). I have examined the holotype (FMNH 4492) of *Carpiodes labiosus*, 194 mm. S.L., and find that it agrees with the generic characters used by Hubbs (1930, p. 8) for the recognition of *Ictiobus*, although it appears to be an extreme representative in head shape and lip modification: the anterior fontanelle is virtually closed, the cheek is relatively deep and long, and the subopercle is subtriangular.

The genus *Pantosteus* was synonymized with *Catostomus* (Smith, 1966, pp. 42-46), largely on the basis that two species, *columbianus* and *plebeius*, are intermediate between *Catostomus* (s.s.) and *Pantosteus* and that these two genera frequently hybridize (and even backcross) when sympatric; hence the Rio Grande sucker is now called *Catostomus plebeius* Baird and Girard by many workers. Minckley and Deacon (1968) and especially Minckley (1973, pp. 167-169), however, believe that both genera should be recognized, and cogent reasons for this are given in the latter reference. I am inclined to accept that conclusion.

Examination of Meek's material (FMNH 3566) of *Pantosteus plebeius* from Miñaca, Chihuahua, on the Río Papigochic (a headwater of Río Yaqui), discloses that 34 specimens are an undescribed species of *Catostomus* and five are presumably *C. bernardini*. *Pantosteus plebeius* does occur in the Río Yaqui basin (e.g., UMMZ 165027), although it appears to be rare there (Smith, 1966, p. 48, fig. 10).

Examination of the types of *Catostomus sonorensis* Meek convinces me that it is a synonym of *Catostomus bernardini* Girard, a

very close relative of *C. insignis* Baird and Girard, from which *C. bernardini* was probably derived. *Catostomus conchos* Meek is also a geographic representative of *C. bernardini* and may not be specifically distinct from it. The high lateral-line scale count (80) given for *C. conchos* by Meek results from an injury to the left side of the holotype that produced regenerated, small scales; the right side of the same specimen (FMNH 3557) has no more than 75, which is included within the known variation of *C. bernardini* (65-75; original data); the paratypes of *C. conchos* (FMNH 3558 and USNM 105090) have about 65 to 70 lateral-line scales (74 on right side of one).

The proper name for the razorback sucker is *Xyrauchen texanus* (Abbott), as shown by Fowler (1913, pp. 54-55). Baja California records are summarized by Follett (1960, p. 216).

*Myzostoma* for Rafinesque's spelling *Moxostoma* is one of Meek's attempts to correct the spelling of a generic name. "Daniel Giraud Elliot, then chief curator of the Zoology Department of the Field Museum, an English-born purist and self-assumed classicist" provided Meek with such emendations as *Pimelocephales* for *Pimephales* and *Lepidopomus* for *Lepomis* (Carl L. Hubbs, pers. comm., May 9, 1974).

*Moxostoma congestum* (Baird and Girard) is now definitely known to inhabit only those streams in extreme northeastern México that drain into the Rio Grande below Big Bend National Park, and from thence southward to Río Soto la Marina (Robert E. Jenkins, pers. comm., May 13, 1974); however, it did inhabit the Rio Grande at El Paso in 1891 (Woolman, 1894, p. 56; USNM specimens checked by Jenkins). Meek's record of the species from the Rio Conchos basin (Santa Rosalia) is actually *M. austrinum* Bean (specimens checked by Jenkins), which also lives in the United States in Alamito Creek, Presidio County, Texas (USNM 212109, UMMZ 182360, 196771).

*Cycleptus elongatus* (Lesueur) was not listed in Meek's book but was later recorded by him (Meek, 1908, p. 154) for the first time in México from Rodríguez in the Río Salado basin of Nuevo León (FMNH 5575).

### Cyprinidae

In México *Campostoma* comprises two well-marked species that are readily distinguished by scale size (large in *C. anomalum* (Rafinesque), small in *C. ornatum* Girard). After examination of syntypes of *Campostoma formosulum* Girard, I agree with Regan (1906-1908,

p. 150) and Fowler (1924, p. 389) that it is a synonym of *C. anomalum*.

*Xystrosus* represents a distinctive lacustrine adaptation of *Algansea* noteworthy for its numerous gill rakers, but it is regarded as only a subgenus of *Algansea* by Barbour and Miller (ms).

In the above revision of *Algansea*, Barbour and Miller synonymize *A. dugesi* Bean and *A. rubescens* Meek with *A. tincella* (Valenciennes).

The material referred by Meek to *Hybognathus* is regarded as pertaining to the genus *Dionda* by Hubbs and Miller (in press). *Hybognathus* does occur in México (as *H. nuchalis* Agassiz), but only in the lower Río Grande basin (Miller, in press b).

The species called *Hybognathus rasconis* (Jordan and Snyder) by Meek was briefly discussed by Hubbs and Miller (1974, pp. 2-4). Meek's material from Forlón, in the Río Tamesí basin, represents *D. erimyzonops* Hubbs and Miller (1974) and *D. ipni* (Alvarez and Navarro); that from Valles, in the Río Pánuco basin, is *D. ipni*; and the specimens collected in Río Verde near Río Verde, San Luis Potosí, are an undescribed species of *Dionda* (Hubbs and Miller, in press). *Dionda rasconis* appears to be restricted to upland tributaries of the Río Frío (sometimes called Río Gallinas), near and above Rascón, San Luis Potosí (Hubbs and Miller, in press).

*Pimephales confertus* (Girard) was assigned to subspecific status, *Pimephales promelas confertus*, by Hubbs and Ortenburger (1929a, p. 38) who noted that Meek's counts of lateral-line scales for his Mexican material were too high (52-55 instead of 43-49, evidently because Meek often counted the scales along the base of the caudal fin). Meek's spelling *Pimelocephales* has been explained above.

*Ptychocheilus lucius* Girard, a species confined to the Colorado River basin, was listed by Meek from Sonora on the basis of Bean's (1898, p. 165) record from northern Sonora, México (Locality 45, N Sonora, F. Robinette coll.). Diligent search by myself, Donn Rosen, and staff in the fish collections of the American Museum of Natural History (including checking all material catalogued as *Gila*), failed to disclose the two specimens (8¾ and 12½ in. long) described by Bean. Five of the six species recorded in his paper were located, however, including AMNH 1225, *Catostomus bernaldini* Girard (180 and 280 mm. long), which came from the same station as his *Ptychocheilus*. Careful comparison with specimens of *P. lucius* from Arizona, of the same size as Bean's material, strongly suggests that the species Bean had was *Gila robusta* Baird and Girard. The eye in

*P. lucius* is much smaller and the maxilla extends well beyond the eye, even in the smaller specimen, whereas the eye is larger in *G. robusta* (as in Bean's material) and the maxilla reaches barely beyond a vertical from the front of the eye in large adults and falls short of it, as described by Bean for the smaller of his two specimens of "*Ptychocheilus lucius*." In addition, *Catostomus bernardini* is only known from south of the Colorado River basin. I am thus confident that the Sonora record of the Colorado squawfish was based on *Gila robusta*, a species known from the Río Yaqui basin (see *G. minacae*, below). Baja California records of *Ptychocheilus* are discussed by Follett (1960, p. 216).

Mexican records of *Gila elegans* Baird and Girard (also called *G. r. elegans* in recent years) are summarized by Follett (1960, p. 216).

*Gila minacae* Meek, from Miñaca on Río Papigochic, an upper tributary of Río Yaqui, is the same as *Gila robusta* (Miller, 1959a, p. 215); examination of the holotype (FMNH 3573) shows it to have nine rays in the dorsal, anal, and pelvic fins, fine scales (about 89 in lateral line), and a moderately slender caudal peduncle—traits of the typical subspecies, *Gila r. robusta* Baird and Girard, according to Minckley (1973, p. 100).

No North American cyprinids are now referred to the Eurasian genus *Leuciscus*. Meek included two species, *L. nigrescens* (Girard) and, hypothetically, *L. intermedius* (Girard). Both are now assigned to *Gila* (Miller, 1945). Three species listed in the synonymy of *L. nigrescens* are valid: *G. pulchra* (Girard), *G. conspersa* Garman, and *G. modesta* (Garman) (see Miller, in press b). The material listed under *L. nigrescens* from Miñaca (FMNH 3564a), in the Río Yaqui basin, is *Gila pulchra*, which also lives in the Río Conchos basin of Chihuahua. *G. conspersa* lives in the Río Nazas basin; *G. modesta* in the Río Salinas basin near Saltillo.

*Gila intermedia* (Girard), recognized as a full species by Minckley and Deacon (1968) and by Minckley (1973), was taken in Río Santa Cruz in extreme northern Sonora by John H. Clark in 1851 (Girard, 1859, p. 64, as *Tigoma gibbosa*). It no longer lives there.

*Abramis* is now regarded as an Old World genus. Although *Notemigonus crysoleucas* (Mitchill) was recorded by Jordan from Brownsville, Texas (not now verifiable from preserved material), many of his records attributed to that locality have been shown to be erroneous (Clark Hubbs, 1954); moreover, Robinson (1959) failed to take the species during extensive collecting in the lower Río Grande. Since there is no evidence that this species has ever been collected in the Río Grande (Clark Hubbs, pers. comm., May 8,

1974), it should be excluded from the Mexican fresh-water fish fauna.

*Cochlognathus ornatus* Baird and Girard was shown by Hubbs and Ortenburger (1929a, p. 36; see also Hubbs and Black, 1947, p. 31) to be a synonym of *Ceratichthys vigilax* Baird and Girard, a species now referred to the genus *Pimephales* (Bailey, 1951, p. 193; Cross, 1953).

The species now generally known as *Hybopsis alta* (Jordan) has had a tangled nomenclatural history. Meek referred it to *Falcula* Jordan and Snyder, calling it *F. chapalae*, but that species is a synonym of *Hudsonius altus*. When *Falcula* was found to be preoccupied, Jordan (1903, p. 360) renamed it *Falcularius*. Earlier, however, Jordan and Evermann (1896, pp. 314, 315, 321) erected the subgenus *Yuriria* for *Hudsonius altus* (on the basis of dentition and a large, terminal mouth) and this name was subsequently elevated to full generic status (Jordan et al., 1930, p. 137). Meek (p. 80), however, synonymized *Yuriria* with *Hybopsis*, a logical action. *Falcularius* was thought not to have a barbel and hence was regarded as not closely related to *Yuriria*, in which the small barbel was noted (for example, Meek treated *chapalae* on p. 58 and *alta* on p. 81). But *F. chapalae* also has a small barbel, sometimes missing on one or both sides, and, in fact, the two nominal genera represent the same species (as first determined by Carl L. Hubbs, unpublished). Whether or not *Yuriria* is a valid genus is still debatable but for the present I choose to retain *alta* in *Yuriria* (see also Alvarez, 1970), rather than shift from one uncertainty to another. As worked out with Ted Cavender, *Yuriria* differs from *Hybopsis* in having: (1) the supraorbital canal with extensions onto the parietal bone, (2) the laminar part of the preopercle broadly expanded, the vertical and horizontal limbs of this bone equal, (3) numerous pores in the cephalic sensory canals, and (4) the sensory canal pores enlarged (see also Smith et al., 1975). If the species were to be assigned to *Hybopsis*, then the recent proposal to combine *Hybopsis* with *Notropis* (Cortés, 1968) would make it still uncertain whether to call the fish *Hybopsis alta* or *Notropis altus*. (See also discussion in Hubbs and Miller, 1974). Whether *Hybopsis* and *Notropis* should be combined or not is under study by Robert E. Jenkins.

The nominal genus *Aztecula* Jordan and Evermann, with type species *Notropis aztecus* Woolman (= *Codoma vittata* Girard) from the Valley of México, has had a similarly tangled history, as follows: *Leuciscus vittatus* DeKay, a synonym of *Notropis cornutus* (Mitchill), has priority over *Codoma vittata*, so if *Aztecula* is not

recognized and the species is referred to *Notropis*, then *N. aztecus* is the proper name of the type species of *Aztecula*. Moreover, *Ceratichthys sallaei* Günther, from Cuernavaca (in the Río Balsas basin), erroneously referred to *Algansea* by Jordan and Evermann (1896, p. 212) and others, may be specifically indistinguishable from that species. Meek (1904, p. 45, ftn.) was properly concerned about an *Algansea* inhabiting the Río Balsas basin (where that genus is unknown today) and suggested that Günther's fish actually came from the Valley of México. However, this type of cyprinid does inhabit the Balsas system near Puebla (UMMZ 191695). Until I have examined the types of *C. sallaei*, I tentatively refer the complex of species included by Meek in *Aztecula* to a single species, *Notropis sallaei*. *Aztecula*, if valid, has the reduced dentition typical of so many Mexican cyprinids (0,4-4,0), small scales (50 or more in lateral line), head rounded and snout very blunt, small upturned mouth, small fins, small eye, generally plain coloration (except that nuptial males are strongly bicolored), small, profuse nuptial tubercles over head and most of body, and intestine with a single, simple loop (Type 1 of Kafuku, 1958, fig. 7).

The genus *Notropis* is represented in México by at least 20 species (Miller, in press b), including several still undescribed. Some Mexican cyprinids assigned to *Notropis* by Meek and others likely will be placed in other genera, but in the present confusion regarding the generic classification of the Cyprinidae a concept of the genus *Notropis* and its subdivisions is not yet clear. One species that I feel should be removed is *Notropis ornatus* (Girard), which I tentatively retain in *Codoma* for reasons given later (see also Miller, in press b).

Of the remaining species placed by Meek in *Notropis*, *N. robustus* (Meek) is probably not distinct from *N. braytoni* Jordan and Evermann. It was synonymized with that species by Hubbs and Hubbs (1958, p. 300); the dorsal and anal rays are 8 and 7, respectively, in both *robustus* and *braytoni*, not 9 and 8 in *robustus* as recorded by Meek. Meek's records of *braytoni* from Garza Valdez, La Cruz, Santa Engracia, and Victoria all refer to *N. aguirrepequenoi* Contreras-Balderas and Rivera-Teillery (1973), since they are in the basin of Río Soto la Marina where that species but not *braytoni* lives (Contreras-Balderas, pers. comm., 1975).

*Notropis boucardi* (Günther) has generally been treated as a species of *Hybopsis*, except by Cortés (1968); some trait other than the presence or absence of a maxillary barbel will be required to dis-



tinguish *Hybopsis* if that genus is to be separated generically from *Notropis*.

*Notropis orca* Woolman is a synonym of *Notropis simus* (Cope), which was erroneously transferred to *Hybopsis* by Jordan et al. (1930, p. 135). Both species were described from the Rio Grande, and comparison of the type series of each (CAS-SU 2278 and USNM 16982, respectively) reveals no basis for specific separation, despite the assignment of *orca* to a separate subgenus, *Orcella*, by Jordan and Evermann (1896, pp. 254, 289). There are differences between the type series (from San Ildefonso, New Mexico, and El Paso, Texas), for example, in number of anal rays and position of dorsal fin (9 *vs* 8 and fin more posterior in *simus*), but intergradation of these features occurs within the drainage. Clark Hubbs (1957, p. 6) recognized only *N. simus* from Texas, thereby tacitly synonymizing the two.

*Notropis forlonensis* Meek has been aligned as a subspecies of *N. lutrensis* (Baird and Girard) by C. L. Hubbs (1954, p. 293); Meek recognized its close resemblance to that species.

*Notropis rutilus* (Girard) is a valid species confined to northeastern México (see, for example, Minckley and Lytle, 1969).

*Notropis macrostomus* (Girard) is a synonym of *N. amabilis* (Girard), as determined by C. L. Hubbs who compared the types of both species in the U. S. National Museum. My examination of this material (USNM 129 and 72, respectively) supports his conclusion. Both species were described from Texas but only *N. amabilis* is recognized from that state by Clark Hubbs (1957, p. 6).

*Notropis garmani* Jordan is very close to, and perhaps only a subspecies of, *N. lutrensis*; this is true also of *N. santamariae* Evermann and Goldsborough and *N. formosus* (Girard), closely related taxa. Minckley (1973, pp. 138-139) recognized *formosus* as a separate species and I (Miller, in press b) followed his action.

*Notropis frigidus* (Girard) is a synonym of *N. l. lutrensis* (Hubbs and Ortenburger, 1929b, p. 74). The small, mutilated specimen from a pool near Lago Santa María, Chihuahua, referred to this species by Evermann and Goldsborough (1902, p. 148), should be assigned to *N. santamariae* (see above), which was described by them on the previous page from the lake of that name.

*Notropis santarosaliae* Meek is a synonym of *Notropis jemezianus* (Cope), as shown by examination of the types (holotype, FMNH

3535, 17 paratypes, 59532) from Río Nonoava at Santa Rosalia (now called Ciudad Camargo), Chihuahua.

Included by Meek and others as a synonym of *Notropis* is the monotypic genus *Codoma*, type species *Codoma ornata* Girard, 1856 (see Girard, 1859, p. 53, pl. 29, fig. 22). This species, currently assigned to *Notropis*, was included in the subgenus *Cyprinella* by Gibbs (1957), who stressed the naturalness of this group of *Notropis*. I (Miller, in press b) have pointed out that *N. ornatus* lacks some of the characters used by Gibbs to diagnose *Cyprinella*, and have noted other features that seem to set this species apart from others referable to *Notropis*. Moreover, according to observations of spawning behavior by W. L. Minckley (pers. comm., 1973), this species spawns upside down under rocks, a behavior unknown for *Cyprinella* but characteristic of *Pimephales promelas*. Hence *Codoma ornata* is tentatively adopted as the name for this fish until generic relationships among American cyprinids are better understood. *C. ornata* looks more like a *Pimephales* than a *Notropis*; it may lie near the basal stock from which the Pimephalini sprang.

The genus *Phenacobius* does not occur in México. Its inclusion (as *P. scopifer* = *P. mirabilis*) by Meek was on the supposed basis of its occurrence at the mouth of the Río Grande. Clark Hubbs (1954, p. 279) showed this record to be most improbable, and Robinson (1959) confirmed that conclusion by failing to collect this genus anywhere in the lower Río Grande. The distribution of *P. mirabilis* (Girard) has been mapped by Trautman (1957, map 71).

*Rhinichthys simus* Garman is a synonym of *Rhinichthys atratulus* (Hermann), as pointed out by Hubbs (1936b, p. 125), who showed that the type came from Coahulla Creek, Georgia (not Coahuila, México). Meek's material (FMNH 4420) from Montemorelos, Nuevo León (in the Río San Juan basin), was reidentified as *Rhinichthys cataractae* (Valenciennes) by C. L. Hubbs; another lot (FMNH 3531), collected by Meek and Lutz at Santa Rosalia (=Cd. Camargo), Chihuahua, but not listed in Meek, also represents *R. cataractae*.

Meek treated *Apocope* as a synonym of *Agosia* but *Apocope* is now interpreted as congeneric with *Rhinichthys* (see review by Hubbs et al., 1974, p. 97). *Agosia* is represented by *A. chrysogaster* Girard, whereas *Agosia oscula* is *Rhinichthys osculus* (Girard), which barely enters the Mexican fauna in that part of Río Santa Cruz which swings through northern Sonora on its way to Gila River, Arizona.

The reported occurrence of a species of *Couesius* in México remains an enigma, for this genus is otherwise essentially Canadian in distribution (McPhail and Lindsey, 1970, p. 242; Scott and Crossman, 1973, p. 403). Examination of the three syntypes of *Couesius adustus* Woolman by Robert E. Jenkins and Clyde D. Barbour (pers. comm., 1973) revealed that at least two genera (one of which is *Algansea*) are involved. The possibility of a mixup in the locality and association of the specimens must be considered. No fish conforming to Woolman's description has been taken in the Río Conchos basin since 1891 despite much collecting there during the past 75 years.

*Plagopterus argentissimus* Cope was included by Meek in the Mexican fish fauna probably because the records from Yuma, Arizona, so closely approach México. However, all known occurrences of this species are in the United States (see Miller and Hubbs, 1960, fig. 1).

### Characidae

Myers (1949) has shown that the proper spelling for this family of fishes is Characidae (not Characinidae).

Both *Tetragonopterus* and *Astyanax* are now regarded as valid genera, but species of the former genus are restricted to South America (Eigenmann, 1917). *Astyanax mexicanus* (Filippi) and *A. aeneus* (Günther) have been assigned to the same species, *A. fasciatus* (Cuvier), although the full supporting data for this action have never been published. This explains why *A. mexicanus* is frequently used (e.g., by Bailey et al., 1970) and why I have used it in a recent paper (Miller, in press b). The complex of forms of *Astyanax* through Middle to South America has received innumerable local names; a comprehensive treatment of these highly variable characins has yet to be presented.

*Hemigrammus compressus* Meek was made the type species of the genus *Hyphessobrycon* Durbin (in Eigenmann, 1908, p. 100), a name in current use. This is the only Mexican species (Miller, 1966, p. 785).

### Synbranchidae

The above modified spelling of this family name has been in use for some time. Donn E. Rosen and P. H. Greenwood are currently revising this family and their paper is expected to result in modifications regarding the number of genera and species occurring in México (Rosen, pers. comm., 1974). *Synbranchus marmoratus*

Bloch lives in México only on the Pacific coastal plain of Oaxaca and Chiapas.

### Anguillidae

The American eel is now called *Anguilla rostrata* (Lesueur). It occurs from southwestern Greenland to Colombia, including the West Indies, entering rivers along the Atlantic slope (Miller, 1966; Scott and Crossman, 1973).

### Clupeidae

The gizzard shads, placed by Meek in a separate family, the Dorosomatidae, are now generally included within the Clupeidae (Hildebrand, 1963, p. 262). *Dorosoma exile* Jordan and Gilbert is a synonym of *D. cepedianum* (Lesueur) and *Signalosa* is now generally treated as a synonym of *Dorosoma* (Miller, 1963); the Mexican species is currently called *Dorosoma petenense* (Günther), as by Miller (1966, p. 794). Meek's second citation under *Dorosoma exile* (the reference to L. Catemaco) also refers to *D. petenense*.

### Salmonidae

*Salmo irideus* Gibbons has long been treated as a subspecies of *Salmo gairdneri* Richardson, as by Miller (1950, p. 4). The four specimens from Arroyo San Antonio, tributary to Río Santo Domingo, Baja California, mentioned by Meek, could not be found. This is the population described by Evermann (1908) as *Salmo nelsoni* Evermann and discussed recently by Follett (1960, p. 215).

### "POECILIIDAE"

Meek (1904, pp. 98-159) placed all cyprinodontoids in the Order Haplomi and in the Family Poeciliidae. This classification has long since been abandoned. His Poeciliidae actually represents four families: Cyprinodontidae, Goodeidae, Poeciliidae, and Anablepidae. The following list uses the modern family terminology, with Meek's genera and their presently accepted names, if different, in parentheses:

Cyprinodontidae—*Cynodonichthys* (*Rivulus*), *Fundulus* (*Fundulus*, *Profundulus*), *Lucania*, and *Cyprinodon*.

Goodeidae—*Zoogoneticus* (*Zoogoneticus*, *Profundulus*, *Allophorus*), *Girardinichthys*, *Characodon* (*Characodon*, *Girardinichthys*, *Xenotoca*, *Ilyodon*), *Chapalichthys*, *Goodea* (*Goodea*, *Ilyodon*, *Ataeniobius*), and *Skiffia*.

Poeciliidae—*Pseudoxiphophorus* (*Heterandria*), *Gambusia* (*Gambusia*, *Poeciliopsis*, *Priapella*), *Paragambusia* (*Gambusia*), *Glaridichthys* (*Poeciliopsis*), *Belonesox*, *Platypoecilus* (*Xiphophorus*,

*Poecilia*), *Heterandria* (*Poeciliopsis*), *Poecilia* (*Poecilia*, *Poeciliopsis*, *Xiphophorus*), *Mollienesia* (*Poecilia*), and *Xiphophorus*.

Anablepidae—*Anableps*.

### Cyprinodontidae

The distribution of *Cynodonichthys tenuis* Meek, now referred to *Rivulus*, has recently been treated by Miller and Carr (1974, p. 122).

*Fundulus guatemalensis* Günther, *F. punctatus* Günther, *F. labialis* Günther (pp. 103-107), and *Zoogoneticus pachycephalus* (Günther) (p. 112), extralimital species included in Meek's book, are members of the genus *Profundulus* (Miller, 1955b), as is *F. oaxacae* Meek.

*Fundulus vinctus* Jordan and Gilbert and *F. extensus* Jordan and Gilbert, said to have come from Cape San Lucas, Baja California, "were apparently based on specimens of the common Atlantic Coast species, *F. heteroclitus* (Linnaeus) and *F. diaphanus* (Le Sueur), respectively" (Miller and Hubbs, 1954).

Meek's records (Linares, Victoria) of *Fundulus similis* Günther pertain to *F. grandis* Baird and Girard (Hubbs, 1926, p. 7). *F. heteroclitus* (Linnaeus) does not occur in México, but is represented in its northeastern part by *F. grandis* (Miller, 1955a, p. 8). Meek's reference to Yucatán material of *grandis* refers to *F. grandissimus* Hubbs (1936a, pp. 209-210, pl. 2, figs. 3-4).

*Fundulus zebrinus* (Jordan and Gilbert) is one of a number of species erroneously recorded from the mouth of the Rio Grande at Brownsville (Clark Hubbs, 1954; Miller, 1955a).

*Lucania venusta* (Girard) is a synonym of *Lucania parva* (Baird and Girard) (see Hubbs and Miller, 1965).

Under the synonymy of *Cyprinodon eximius* Girard, the record of *C. elegans* from "lagoons near Tampico" refers to *C. variegatus* Lacépède; thus this species does not inhabit the Río Pánuco basin (Darnell, 1962).

*Cyprinodon elegans* Baird and Girard is confined to Texas (Miller, 1951). Meek's records refer to an undescribed species of *Cyprinodon*, but his reference to Bean's material from Chihuahua should be referred to *C. eximius*.

Mexican records for *Cyprinodon macularius* Baird and Girard have been given by Miller (1943) and Follett (1960).

*Cyprinodon latifasciatus* Garman was confined to the Parras basin, Coahuila, where it is now extinct (Miller, 1964). Meek's records from Río Nazas and headwaters of Río Mezquital pertain to undescribed species of this genus (Miller, in press c).

### Goodeidae

Much of the generic classification of this family that is adopted here was proposed in the revision by Hubbs and Turner (1939), to which the reader is referred. Modifications of that classification have been made recently by Miller and Fitzsimons (1971).

*Zoogoneticus dugesi* (Bean) is assigned to the genus *Allotoca*; *Z. robustus* (Bean) and *Z. maculatus* Regan, its synonym (Regan, 1906-1908, p. 87), are assigned to the genus *Allophorus*; *Z. minutus* Meek is a synonym of *Z. diazi* Meek and did not come from the Valley of México (see Alvarez and Navarro, 1957).

*Girardinichthys inominatus* Bleeker is preoccupied by *G. viviparus* (Bustamente) (see Alvarez and Navarro, 1957); it is the only goodeid inhabiting the Valley of México.

*Characodon multiradiatus* Meek, made the type of the genus *Lermichthys* by Hubbs and Turner (1939, p. 68), was synonymized with *Girardinichthys* by Miller and Fitzsimons (1971). *C. eiseni* Rutter is a species of *Xenotoca* (Fitzsimons, 1972); it does not occur in the lowlands of Jalisco. *C. variatus* Bean is also a *Xenotoca*, but *C. garmani* Jordan and Evermann is a synonym of *Characodon lateralis* Günther (Fitzsimons, 1972), a species now known only from the basin of the Río Mezquital in and near the city of Durango. *C. fuscidentis* Jordan and Gilbert is a species of *Ilyodon*; all of the Cape San Lucas records are erroneous (Miller and Hubbs, 1954) as is the one from Río San Pedro, Jalisco.

*Goodea whitei* Meek is a member of the genus *Ilyodon*, and *G. toweri* Meek is the only known species of *Ataeniobius*.

*Skiffia variegata* Meek was synonymized with *S. lermiae* Meek by Miller and Fitzsimons (1971). Examination of the type material of each confirms this action. Body depth (supposedly a distinguishing feature), coloration, and markings (dark bar at caudal base) are all too variable to suggest that these two are full morphological species.

### Poeciliidae

*Pseudoxiphophorus* is currently referred to *Heterandria*, with two species in México—*H. bimaculata* (Heckel) and *H. jonesi* (Günther). *P. pauciradiatus* Regan is a synonym of *H. jonesi*. Meek's account thus includes both species (Miller, 1974a).

*Gambusia fasciata* Meek is a valid species of *Poeciliopsis*, as are *G. gracilis* (Heckel), *G. infans* Woolman, and *Glaridichthys latidens* (Garman) (see Hubbs and Miller, 1954; Miller, 1960; Rosen and Bailey, 1963). Meek was correct in suspecting the locality, Chihuahua,

for *P. latidens*, as this species occurs only along the Pacific coastal plain of México from San Blas, Nayarit, to Sonora. Meek's records of *G. gracilis* from the Río Balsas basin (Cuautla, Yautepec, Jojutla, Chietla) all represent *Poeciliopsis balsas* Hubbs (1926, p. 66).

Included in the synonymy of *Gambusia affinis* (Baird and Girard) are two valid species of *Gambusia*: *G. nobilis* (Baird and Girard), which lives only in Texas and New Mexico, and *G. senilis* Girard (Hubbs and Springer, 1957). *G. bonita* Meek is a species of *Priapella* Regan (1913) (see also Rosen and Bailey, 1963, p. 60).

*Paragambusia nicaraguensis* (Günther) is a species of *Gambusia* but it does not inhabit México (Rosen and Bailey, 1963, pp. 90, 94). Meek's records from five stations in Veracruz and Oaxaca all refer to *G. sexradiata* Hubbs (1936a).

*Platypoecilus* is a synonym of *Xiphophorus*. Meek's record of *P. variatus* Meek from Rascón, San Luis Potosí, represents *X. montezumae* Jordan and Snyder (see FMNH 4514, referred to in last paragraph of p. 159). *P. nelsoni* Meek is *Poecilia butleri* Jordan; the type locality is along the coastal plain of Guerrero, not in the basin of Río Balsas (Schultz and Miller, 1971, p. 284, ftn. 1).

*Heterandria pleurospilus* (Günther) has been identified as *Poeciliopsis gracilis* (Heckel) by Rosen and Bailey (1963, pp. 131, 136), with *H. lutzi* Meek listed as a synonym. The latter may be a valid form, however.

*Poecilia occidentalis* (Baird and Girard) is also a species of *Poeciliopsis* (Hubbs and Miller, 1941), as is *P. presidionis* Jordan and Culver (Regan, 1913). *Poecilia couchiana* (Girard) belongs in *Xiphophorus* (Rosen, 1960).

*Poecilia sphenops* Valenciennes, as treated by Meek, is a mixture of two species, *P. sphenops* and *P. mexicana* Steindachner (see Schultz and Miller, 1971; Menzel and Darnell, 1973). All material from northeastern México (the first 10 localities listed), involving collections from the Río San Juan southward to the Río Pánuco basins, are *mexicana*, whereas those from San Jerónimo, Tehuantepec, and Jojutla (on the Pacific slope) are all *sphenops*. Material from Veracruz, Perez, La Antigua, and San Juan Evangelista (FMNH 4574 and 72573, 4689 and 74074, 3737, 4707) is *mexicana*, although *sphenops* also lives at or near these places; *P. sphenops* is in the El Hule collection (FMNH 4645), but both species are present in Meek's collections from Obispo, Otopa, and Boca del Río. Figure 49, labelled *P. sphenops* and representing the holotype of *P. limantouri* Jordan and Snyder, is *P. mexicana* (Menzel and Darnell, 1973, p. 227).

*Mollienesia* is now assigned to *Poecilia*. *P. latipinna* (Lesueur) occurs only in northeastern México, from about Laguna de Tamiahua, Veracruz, northward, chiefly in brackish water; Meek's record of it from Yucatán represents *P. velifera* (Regan) (see Hubbs, 1936a, pp. 246-248, pl. 9, fig. 4).

*Xiphophorus jalapae* Meek is a synonym of *X. helleri* (Rosen, 1960, p. 117).

### Belonidae

*Tylosurus marinus* (Walbaum) is currently called *Strongylura marina*. Meek's statement that this species often ascends rivers into fresh water refers to two other species: *S. timucu* (Walbaum), recorded from San Francisco, near Veracruz City (FMNH 4568, as determined by Bruce B. Collette), and the fresh-water species *S. hubbsi* Collette (1974) recorded from Río Tesechoacan at Perez, Veracruz. *S. marina* does penetrate into fresh water in the United States (in Florida and along the Gulf Coast) but there do not appear to be any valid fresh-water records for México.

### Syngnathidae

*Siphostoma brevicaudum* Meek is a synonym of *Oostethus lineatus* (Kaup), as determined by Herald (1942, p. 131). *S. starksi* Jordan and Culver is the type species of *Pseudophallus* (Herald, 1940), recently reviewed by Dawson (1974).

### Atherinidae

The genus *Chirostoma* has been revised by Barbour (1973) with the following changes from Meek's presentation: *C. mezquital* Meek is a synonym of *C. jordani* Woolman; *C. zirahuen* Meek is a synonym of *C. attenuatum* Meek; *C. lermiae* Jordan and Snyder is a synonym of *C. sphyraena* Boulenger (as first pointed out by Regan, 1906-1908, p. 63); and *C. ocotlanae* Jordan and Snyder is the same as *C. lucius* Boulenger.

*Menidia sallei* (Regan) was made the type species of *Archomenidia* Jordan and Hubbs (1919), and *Menidia lisa* Meek of *Xenatherina* Regan (1906-1908, p. 64). (The six specimens recorded by Meek from El Hule, FMNH 4651, are *A. sallei*.)

*Thyrina evermanni* Jordan and Culver and *T. crystallina* (Jordan and Culver), which may not be two distinct species, are here referred to *Melaniris* Meek. *Thyrina* is preoccupied in insects (Myers and Wade, 1942, p. 138) and *Melaniris* is the next available generic name. Schultz (1948) recognized *Melaniris* and *Thyrinops* as separate genera, but I do not feel that the characters used by him



warrant generic separation and hence have used only *Melaniris* (Miller, 1966, p. 796; Miller and Carr, 1974).

### Mugilidae

*Neomugil digueti* Vaillant is a synonym of *Agonostomus monticola* (Bancroft), a species discussed by Follett (1960, pp. 220-221).

### Centrarchidae

*Lepidopomus* is an unwarranted emendation for *Lepomis*. *L. cyanellus* Rafinesque may not be native to México (Miller, in press b); the record for Brownsville is definitely erroneous (see discussion of *Notemigonus crysoleucas*, under Cyprinidae). Meek's record (in the synonymy of *L. cyanellus*) of *Pomotis aquilensis* Girard, from Eagle Pass, Texas, refers to *Lepomis megalotis* (Rafinesque), as Girard's figures clearly show. *L. occidentalis* Meek and *L. haplognathus* Cope also are synonyms of *L. megalotis*. *L. pallidus* (Mitchill) and *Eupomotis heros* (Baird and Girard) are synonyms of *Lepomis macrochirus* Rafinesque (Bailey, 1938<sup>1</sup>).

*Micropterus salmoides* (Lacépède) is misspelled *salmonoides*. In Meek's general range statement, the largemouth bass is listed from Tampico, but it does not inhabit the Río Pánuco-Tamesí basin (Darnell, 1962); as Meek correctly indicated at the end of his account, *M. salmoides* is not native south of the Río Soto la Marina basin.

### Percidae

*Etheostoma lepidum* (Baird and Girard) is unknown from México (Miller, in press b); the Brownsville record is erroneous (see discussion of *Notemigonus crysoleucas*, under Cyprinidae).

### Centropomidae

*Centropomus mexicanus* Bocourt is a synonym of *C. parallelus* Poey, an Atlantic-slope species (Regan, 1906-1908, p. 48). This and other Mexican species from the Atlantic slope have been treated by Chávez (1963).

### Pomadasyidae

Meek called this family Haemulidae, once a common practice.

*Pomadasy starri* Meek is a synonym of *P. crocro* (Cuvier) as determined by Regan (1906-1908, p. 44) and confirmed by my examination of the holotype. *P. templei* Meek is also a synonym of

<sup>1</sup> Bailey, Reeve M. 1938. A systematic revision of the centrarchid fishes, with a discussion of their distribution, variations, and probable interrelationships. PhD thesis, Univ. Mich., 256 pp., 10 pls.

*P. crocro* (Meek and Hildebrand, 1925, p. 559); holotype examined. *P. bayanus* Jordan and Evermann and *P. crocro* are very closely related, geminate species (see Follett, 1960).

### Sciaenidae

*Haploidonotus* is an improper emendation of *Aplodinotus*, a strictly fresh-water, monotypic genus, widely distributed in eastern North America.

### Cichlidae

Meek recognized three genera of cichlids in the area of México treated by him, *Cichlasoma*, *Neetroplus*, and *Thorichthys*. Although *Thorichthys* is one of the distinctive, natural groups of *Cichlasoma* (Miller and Nelson, 1961; Rivas, 1962), it has not been ranked higher than a subgenus (as indeed by Meek, 1907) in recent years. *Neetroplus* is currently retained as a genus, but it does not occur in México; *N. carpintis* Jordan and Snyder is a member of the *Herichthys* group of *Cichlasoma* and is very close to, if not identical with, *C. cyanoguttatum* (Baird and Girard), as determined by Regan (1905, pp. 434, 445).

*Cichlasoma mento* (Vaillant and Pellegrin) is evidently confined to the upper Río Grijalva (Río Grande de Chiapa) basin in Chiapas and adjacent Guatemala (Miller, in press a).

*Cichlasoma hedricki* Meek was synonymized with *C. octofasciatum* (Günther) by Regan (1905, p. 445), an action with which I fully concur (Miller, 1966).

*Cichlasoma pavonaceum* (Garman) is a representative of *C. cyanoguttatum*.

*Cichlasoma steindachneri* Jordan and Snyder appears to be restricted to upper tributaries of Río Frio or Río Gallinas, as at Rascón and Tamasopo, San Luis Potosí (fresh collections at UMMZ). Meek's records of it from Forlón and Valles represent an undescribed species, and even his collection (FMNH 4516) from the type locality, Rascón, includes two species, of which one is the true *C. steindachneri*, well portrayed in the illustration of the holotype on page 211.

Meek placed *Cichlasoma labridens* (Pellegrin) in the synonymy of *C. bartoni* (Bean), but both are valid species (Regan, 1906-1908). Among other differences, the lower pharyngeals bear molariform teeth in *labridens* but not in *bartoni*. Meek's description of *C. bartoni* is thus a composite of the two species. All of the specimens examined by Meek from Río Verde at Río Verde, San Luis Potosí, are *C. labridens*, as Regan (1905, p. 443) previously concluded.

*Cichlasoma evermanni* Meek (FMNH 4727, holotype examined) is a synonym of *C. heterodontum* (Vaillant and Pellegrin), as determined by Regan (1905, p. 241), and that species in turn is the same as *C. macracanthum* (Günther) (see Miller, 1966; in press a). Regan (1906-1908, p. 25) commented further on Meek's species. *C. macracanthum* typically has an anal-fin formula of V,9.

In Meek's range statement for *Cichlasoma cyanoguttatum*, the reference to Tabasco is based on a misidentification, as shown by Hubbs (1936a, p. 255); the Tabasco specimen is now the holotype of *C. heterospilum* Hubbs.

*Cichlasoma rectangulare* (Steindachner) was synonymized with *C. intermedium* (Günther) by Regan (1905, p. 232), an action with which I concur.

*Cichlasoma mojarra* Meek is a synonym of *C. trimaculatum* (Günther) (Miller, 1966), not of *C. salvini* (Günther) as Regan (1905, p. 335) thought; *C. salvini* is from waters draining into the Atlantic, *C. mojarra* the Pacific.

Meek's reference, under *Cichlasoma octofasciatum* (Regan), to the record of *Heros cyanoguttatus* by Evermann and Goldsborough was shown by Hubbs (1936a, p. 255) to represent his new species, *C. heterospilum* (see above).

*Cichlasoma parma* (Günther) was synonymized with *C. fenestratum* (Günther) by Regan (1905, p. 228), an action with which Meek (1905, p. 245) subsequently agreed. I have examined Meek's Veracruz material from San Francisco (FMNH 4570, two large adults, of which the male is illustrated as Plate XV), Obispo (FMNH 4671), Perez (FMNH 4696), and El Hule (=Papaloapan, FMNH 4655), and refer all these 23 specimens to *C. fenestratum*. The distribution of this species has been given by Miller (1966, p. 791); it does not occur at Montecristo, Tabasco (the Evermann and Goldsborough record cited by Meek).

*Cichlasoma melanurum* (Günther) is an Atlantic-slope species that does not occur north of the Isthmus of Tehuantepec (Miller, 1966, p. 791). Meek's material may represent a complex of two species (if both are valid), *C. gadowi* Regan and *C. fenestratum* (see Regan, 1905, pp. 442-443), but Meek (1905, p. 245) later concluded that Regan's species was not distinct from *melanurum* (= *fenestratum*), an action that I am inclined to accept. I believe that FMNH 3720 and USNM 55797 (Cuicatlán), FMNH 4614 (Otopa), FMNH 4695 (Perez), and FMNH 4624 (Motzorongo) are all clearly *C. fenestratum*. FMNH 4718 (San Jerónimo, Oaxaca and Ixtepéc, Pacific

slope) is *Cichlasoma zonatum* Meek, which was synonymized with *C. guttulatum* (Günther) by Miller (1966, p. 791) but later was regarded as a valid species (Miller, 1974b, p. 470).

*Cichlasoma nebulifer* should be written *Cichlasoma nebuliferum* (Günther) since the original designation by Günther was *Chromis nebulifera*.

*Cichlasoma deppii* (Heckel) and *C. montezuma* (Heckel), both attributed to México, were synonymized with *Cichlasoma sieboldi* (Kner and Steindachner) by Regan (1905, p. 235). That species, however, is unknown north of Costa Rica. Without an examination of the types of these two nominal species I am unable to identify them; if Regan is correct, the locality data must be grossly in error.

As mentioned above, *Neetroplus carpintis* Jordan and Snyder belongs in the *Herichthys* group and is close to, if not the same as, *Cichlasoma cyanoguttatum*.

The *Thorichthys* group probably contains more species than are currently recognized (Miller and Nelson, 1961; Rivas, 1962). Regan (1905, p. 320) synonymized *C. helleri* (Steindachner) and *C. ellioti* Meek with *C. aureum* (Günther), but after recent study of this group of cichlids I believe that all three species are valid. *C. aureum*, with molariform teeth on the lower pharyngeals, is confined to Guatemala and Belize.

Meek (1906) described *Cichlasoma tenue* from Achotal, Veracruz (Río Papaloapan basin), based on five young-to-juvenile fish. Examination of this material convinces me that Meek (1905) was correct in his original determination of them as *C. trimaculatum*. The nature of the spotting on the side of the body (see Meek's figure of *C. mojarra*) is characteristic of this species, the variants of which have received at least four other names (Miller, 1966, p. 793). Meek's specimens appear emaciated like those from the Río Tehuantepec basin (UMMZ 161489, 161499, 161513), leading to his choice of the specific name; this species is usually more deep-bodied. Regan's (1905, p. 333) description of *C. trimaculatum* fits Meek's material well. Meek's five types have dorsal- and anal-fin formulae of XVI-XVII, 9-11 and VI-VII, 8-9 (not 7 as in the original description). Since *C. trimaculatum* is a Pacific-slope species, the types of *C. tenue* could not have come from Achotal. Further evidence for a locality mixup comes from an examination of FMNH 3780, originally determined as *Cichlasoma parma* and labelled "Achotal Heller and Barber 1904." In this jar are eight specimens of *C. fenestratum* (see above) and seven of *C. macracanthum* which also is a

Pacific-slope species. Perhaps the type locality of *C. tenue* was somewhere near Tehuantepec, Oaxaca.

### GOBIES

Meek placed all gobies in one family, the Gobiidae (as also has been done by some recent workers), but I prefer to retain the Eleotridae (Meek's Eleotridinae) as a separate family.

#### Eleotridae

*Gobiomorus* has long replaced *Philypnus* on the basis of priority. Two species are included in Meek's account of *P. dormitor*: *G. dormitor* Lacépède, from the Atlantic slope, and *G. maculatus* (Günther) from the Pacific. The three Mexican species of *Gobiomorus* have been treated by Miller (1959b).

*Dormitator* comprises two species: *D. maculatus* (Bloch), from the Atlantic slope, and *D. latifrons* (Richardson) from the Pacific. All of Meek's records are of the Atlantic form. The two species are distinguished by Hildebrand (1938, pp. 341-344). The population at Cape San Lucas, Baja California (misidentified by Rutter as *D. maculatus*) was described as *D. latifrons mexicanus* by Ginsburg (1953) and said to range along the Pacific slope of México. Northern Mexican records have been summarized by Follett (1960).

The correct spelling of the Pacific species of *Eleotris* is *E. picta* Kner and Steindachner. This species ranges as far north as the Colorado River, California (Hubbs, 1953).

#### Gobiidae

*Gobius parvus* Meek (FMNH 3738, female holotype examined) is identical with *Evorthodus breviceps* Gill, as described by Meek and Hildebrand (1928, p. 870). That species, in turn, is the same as *Evorthodus lyricus* (Girard), described from Texas. The name *breviceps* is based on the female, and *lyricus* on the male, of this strongly sexually dimorphic goby (Ginsburg, 1931). The species of *Evorthodus*, two of which occur in México, were distinguished by Dawson (1967).

*Gobius claytoni* Meek (FMNH 3740, holotype examined), is a brackish to fresh-water species of *Gobionellus* (Ginsburg, 1932, p. 15). Robins and Lachner (1966) synonymized *G. claytoni* with *Gobionellus fasciatus* (Gill) but unpublished studies by Gilbert and Randall (Gilbert and Kelso, 1971, p. 44) indicate that *G. claytoni* and *G. fasciatus*, though very closely related, are valid species separated by a wide distributional gap.

*Gobius microdon* Gilbert is also a species of *Gobionellus* (Ginsburg, 1932, p. 34). This goby appears to have greater predilection

for brackish or salt water than the preceding one, although it does invade fresh water just above river mouths.

*Chonophorus* is a synonym of *Awaous*, as explained by Ginsburg (1933, pp. 20-21). Two species occur throughout Middle America: *A. tajasica* (Lichenstein) of the Atlantic slope, and *A. transandeanus* (Günther) of the Pacific. *A. nelsoni* Evermann is a synonym of *A. transandeanus*. Baja California records of *A. transandeanus* have been summarized by Follett (1960, p. 225).

*Gillichthys detrusus* Gilbert and Scofield is a synonym of *G. mirabilis* Cooper (Barlow, 1961).

### Soleidae

Two genera of soleids are currently recognized from México: *Achirus* and *Trinectes* (see discussion and references in Hubbs, 1932). *Achirus fonsecensis* (Günther) and *A. fasciatus* Lacépède are valid species of *Trinectes*, but the correct specific name of the latter is *T. maculatus* (Bloch and Schneider) as shown by Hubbs (1932). Meek's material from Perez (FMNH 4702) has been identified as *T. m. fasciatus* (Lacépède) by C. L. Hubbs (pers. comm., 1974).

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